METEOROLOGICAL OFFICE
18 AUG 1977
LIBRARY

MET O 11 TECHNICAL NOTE No. 92

124840

CENTRED OCTAGON USING A SPLIT EXPLICIT TYPE GRID

DAVID A. FORRESTER

NB This paper has not been published. Permission to quote from it must be obtained from the Assistant Director of the above Meteorological Branch.

August 1977

CENTRED OCTAGON USING A SPLIT EXPLICIT TYPE GRID

1. INTRODUCTION

The grid used in the operational split explicit model, in which both the wind components u, v are held at the same points, is believed by some to be superior to grids in which the u and v components are held at different points because no averaging is required in the calculation of the coriolis terms.

The purpose of this note is to report on some experiments carried out with the centred octagon model (Forrester 1976, 1977) modified to use the split explicit grid. The only changes made to the model were those necessary to accommodate the new grid, except that the new model is explicit whereas the centred octagon is semi-implicit. The results of three 3-day integrations show that there is no significant difference in the forecasts.

2. GRIDS AND FINITE DIFFERENCE EQUATIONS

The centred octagon grid is shown in Fig.(1A), and the split explicit grid is shown in Fig.(1B). Both grids are unstaggered in time.

The finite difference equations of the modified model are as follows:-

$$u_{2t} + \mu(u u_{2x} + v u_{2y}) + \bar{\omega}^{x*y} u_{2p} + g \bar{h}^{y}_{x} + \tfrac{1}{2}(u^2 + v^2)\mu_x - fv = 0$$

$$v_{2t} + \mu(u v_{2x} + v v_{2y}) + \bar{\omega}^{x*y} v_{2p} + g \bar{h}^{x}_{y} + \tfrac{1}{2}(u^2 + v^2)\mu_y + fu = 0$$

$$h'_{2t} + \mu[\bar{u}^{x*y} h'_{2x} + \bar{v}^{x*y} h'_{2y}] + \beta w = 0$$

$$h''_{2t} + \mu[\bar{u}^{x*y}(h''-H)_{2x} + \bar{v}^{x*y}(h''-H)_{2y}] + \beta w = 0$$

$$\tau_{zt} + \mu\left[\bar{u}^{x}\partial\tau_{zx} + \bar{v}^{x}\partial\tau_{zy}\right] + \omega\tau_{zp} = 0$$

$$\mu\left(\bar{u}^{x}_{x} + \bar{v}^{x}_{y}\right) + \omega_{p} = 0$$

3. EXPERIMENTS

The new explicit model (referred to as TU(SE)) was run to 3 days using a 2½minute timestep on three occasions (data times 12Z on 7/11/76, 2/1/77 and 23/1/77) and the resulting forecasts were compared with those obtained using the semi-implicit centred octagon (referred to as TU) and with the actuals.

4. RESULTS

The differences between the forecasts produced by the two models are extremely few and small and of no real significance. They are discussed in Section 5.

It is concluded that changing from the centred octagon grid (Fig.(1A)) to the split explicit grid (Fig.(1B)) has neither improved nor worsened the forecast at 3 days.

5. DISCUSSION OF THE FORECASTS

The main differences between the TU(SE) and TU forecasts and the actuals for the 3 case studies are given below.

(1) 7/11/76

PMSL The Newfoundland low has the same (wrong) shape in both models but both centres are slightly further south and the east centre is slightly deeper in TU(SE).

The Pacific low is better positioned, but less deep in TU(SE) and has wrongly developed a secondary centre.

The Pacific high is higher in TU(SE) (worse)

H500 These are almost identical.

(2) 2/1/77

PMSL The Atlantic high has the correct pressure in TU(SE), higher than in TU.

The Pacific low is rougher.

H500 The North Africa Low is positioned slightly further north in TU(SE). (slightly better).

The Pacific low is slightly deeper (better) and the centre is further west (better) in TU(SE) though the shape is a little irregular.

The ridge extending to Ireland is slightly stronger in TU(SE) (wrong).

(3) 23/1/77

PMSL The Atlantic low - both centres are less deep (in fact the pressure is correct) in TU(SE).

The East Canada low is deeper in TU(SE) (Better)

The Alaska low is deeper in TU(SE), but wrongly developed in both models.

The Pacific low is better positioned and deeper (better) in TU(SE)

The Kuril low has the correct central pressure in TU(SE)

The Japan low is more developed in TU(SE) than in TU or actual.

H500 The UK low is less deep in TU(SE) (better)

The East Siberian low is slightly deeper in TU(SE) (correct height).

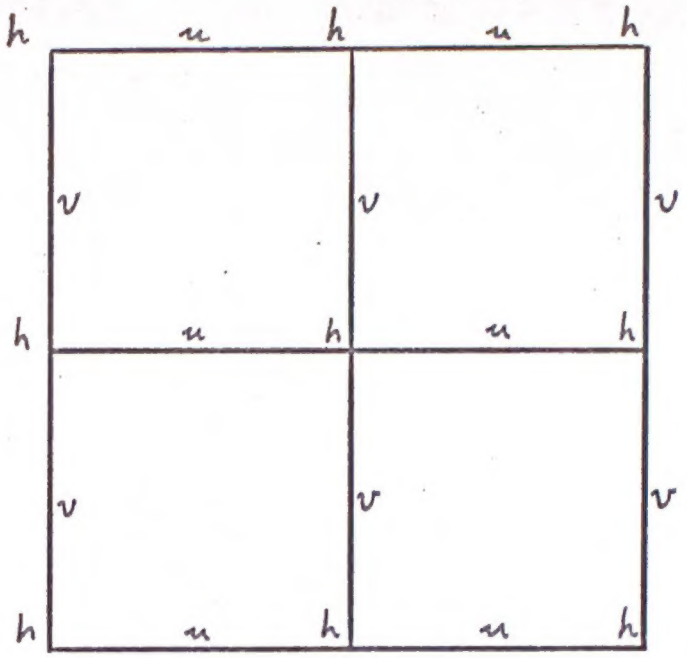
6. PROGRAMMING NOTES

The relevant source modules are named NGOLDMN, NGOCTEW, NGOCTEM, NGADDTH, NGEVENUV, NGEVENTH, NGEVENHØ, NGEVENR, NGOCTDF2, NGOCTSF, and the load module is NGUCOCT.

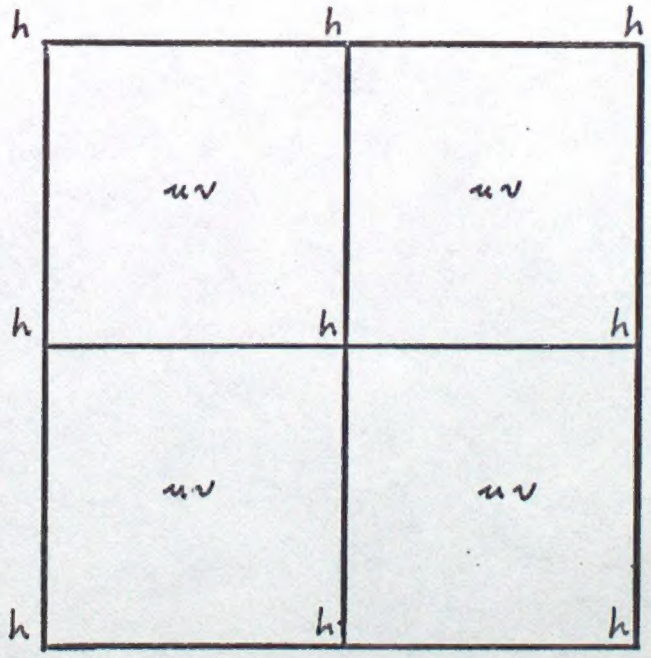
The programs NSEINT and NCORI4 set up the initial data.

REFERENCES

Forrester, D.A.	1976	Met.O.11 Technical Note No.68
Forrester, D.A.	1977	Met.O.11 Technical Note No.90



GRID A

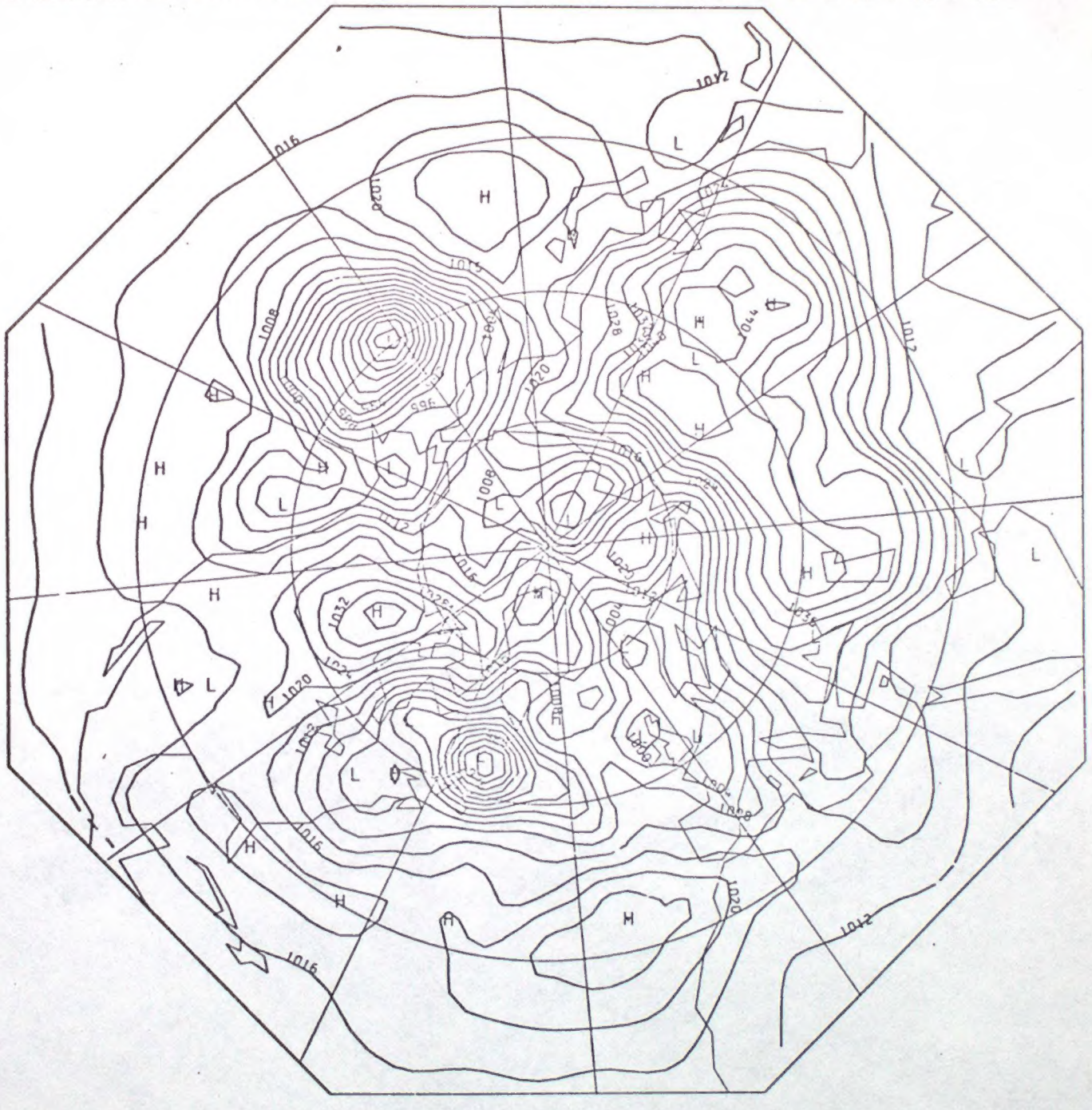


GRID B

FIGURE (1)

M.S.L. PRESSURE ISOBARS AT 4MB INTERVALS

0 HR.FORECAST. DATA TIME 12 Z 10 / 11 / 76. VERIFICATION TIME 12 Z 10 / 11 / 76



1(a) ACTUAL SURFACE PRESSURE 10/11/76

SURFACE PRESSURE ISOBARS AT 4MB INTERVALS

72 HR.FORECAST. DATA TIME 12 Z 7 / 11 / 76. VERIFICATION TIME 12 Z 10 / 11 / 76

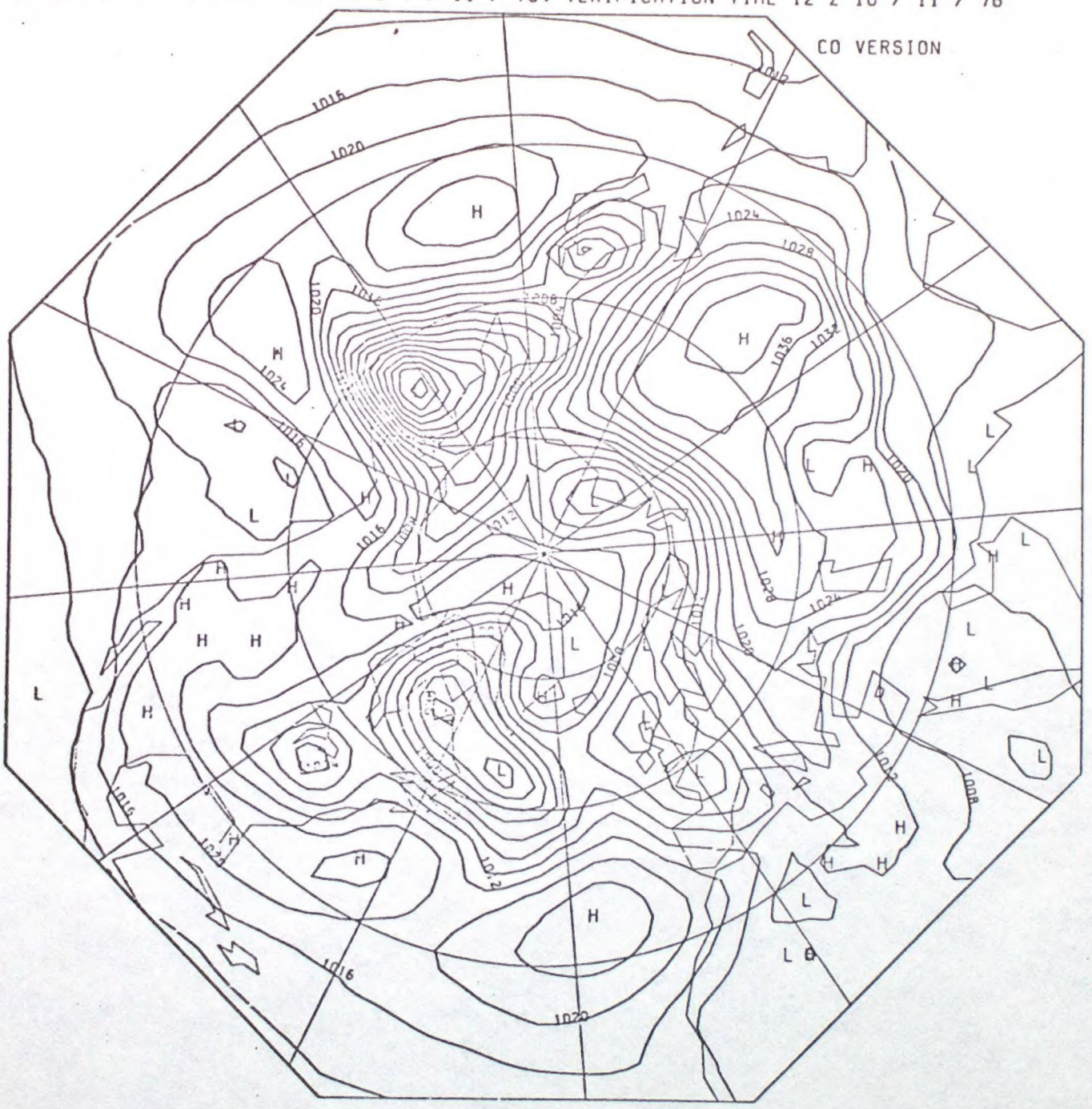
SI VERSION

1(b) TU(SE) SURFACE PRESSURE 10/11/76

SURFACE PRESSURE ISOBARS AT 4MB INTERVALS

72 HR.FORECAST. DATA TIME 12 Z 7 / 11 / 76. VERIFICATION TIME 12 Z 10 / 11 / 76

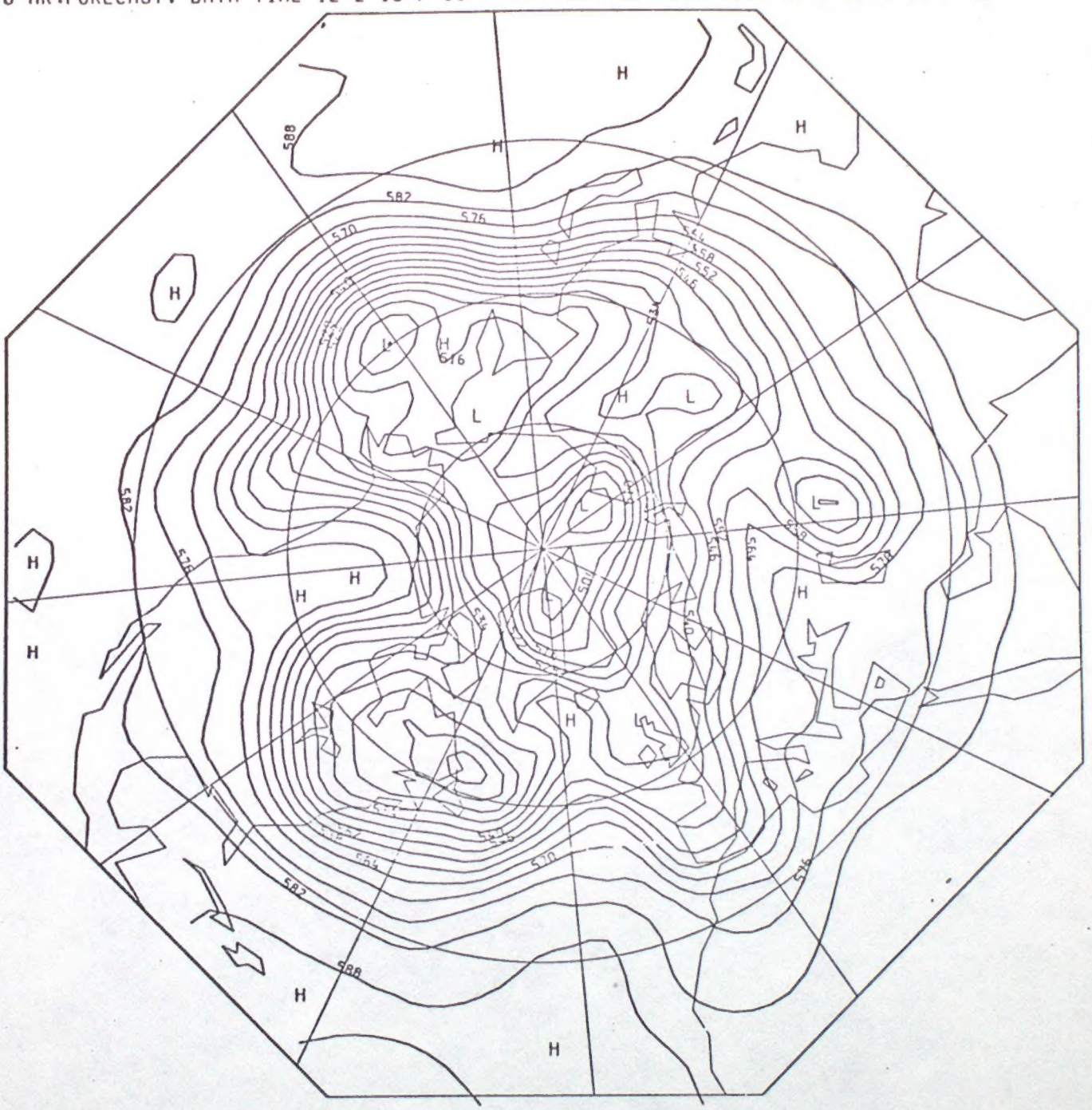
CO VERSION



1(c) TU SURFACE PRESSURE 10/11/76

500 MB HT CONTOURS AT 6 DM INTERVALS

0 HR.FORECAST. DATA TIME 12 Z 10 / 11 / 76. VERIFICATION TIME 12 Z 10 / 11 / 76

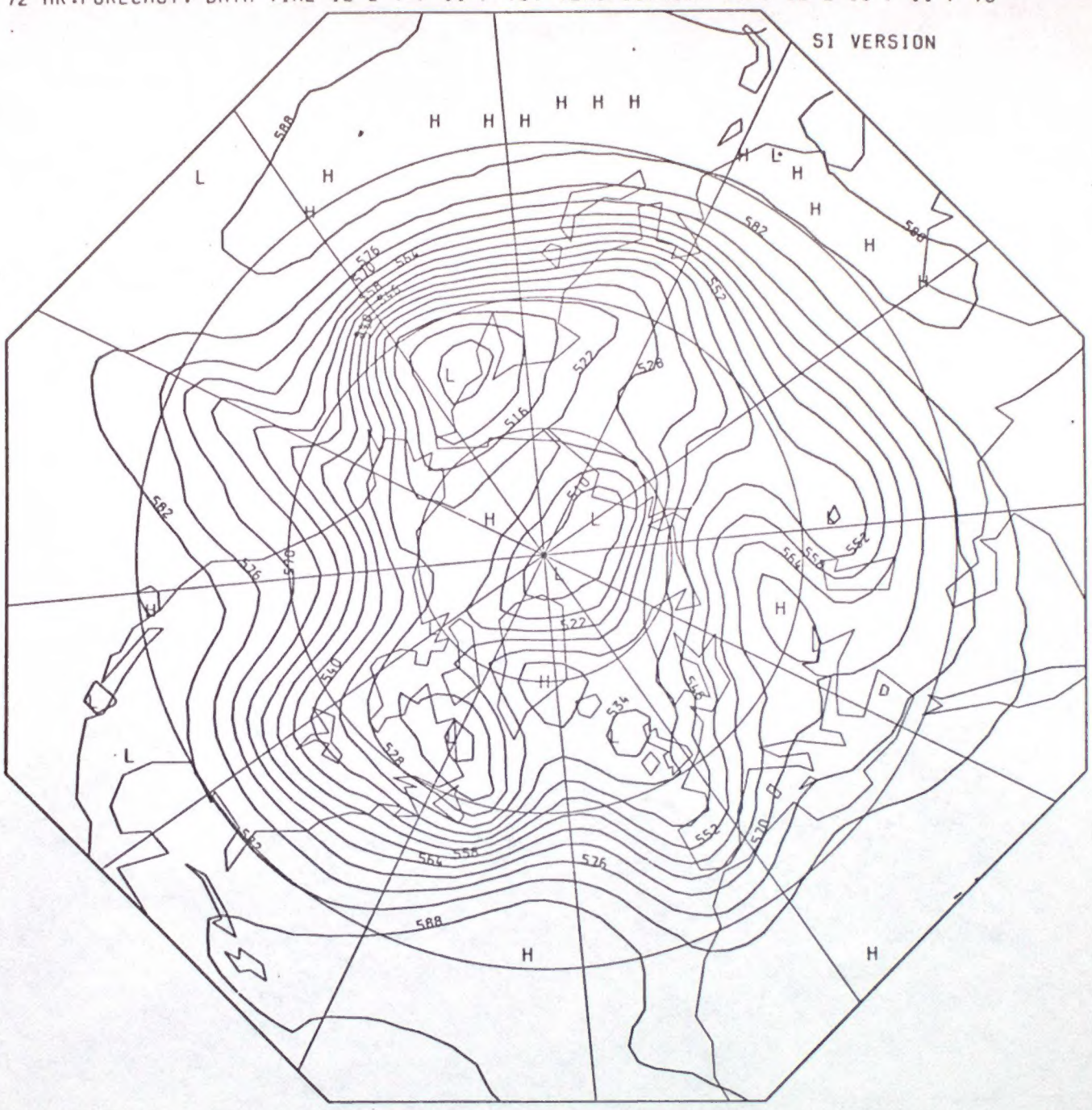


1 (d) ACTUAL 500MB HEIGHTS 10/11/76

500 MB CONTOURS CONTOUR LINES AT 6 DECAMETER INTERVALS

72 HR.FORECAST. DATA TIME 12 Z 7 / 11 / 76. VERIFICATION TIME 12 Z 10 / 11 / 76

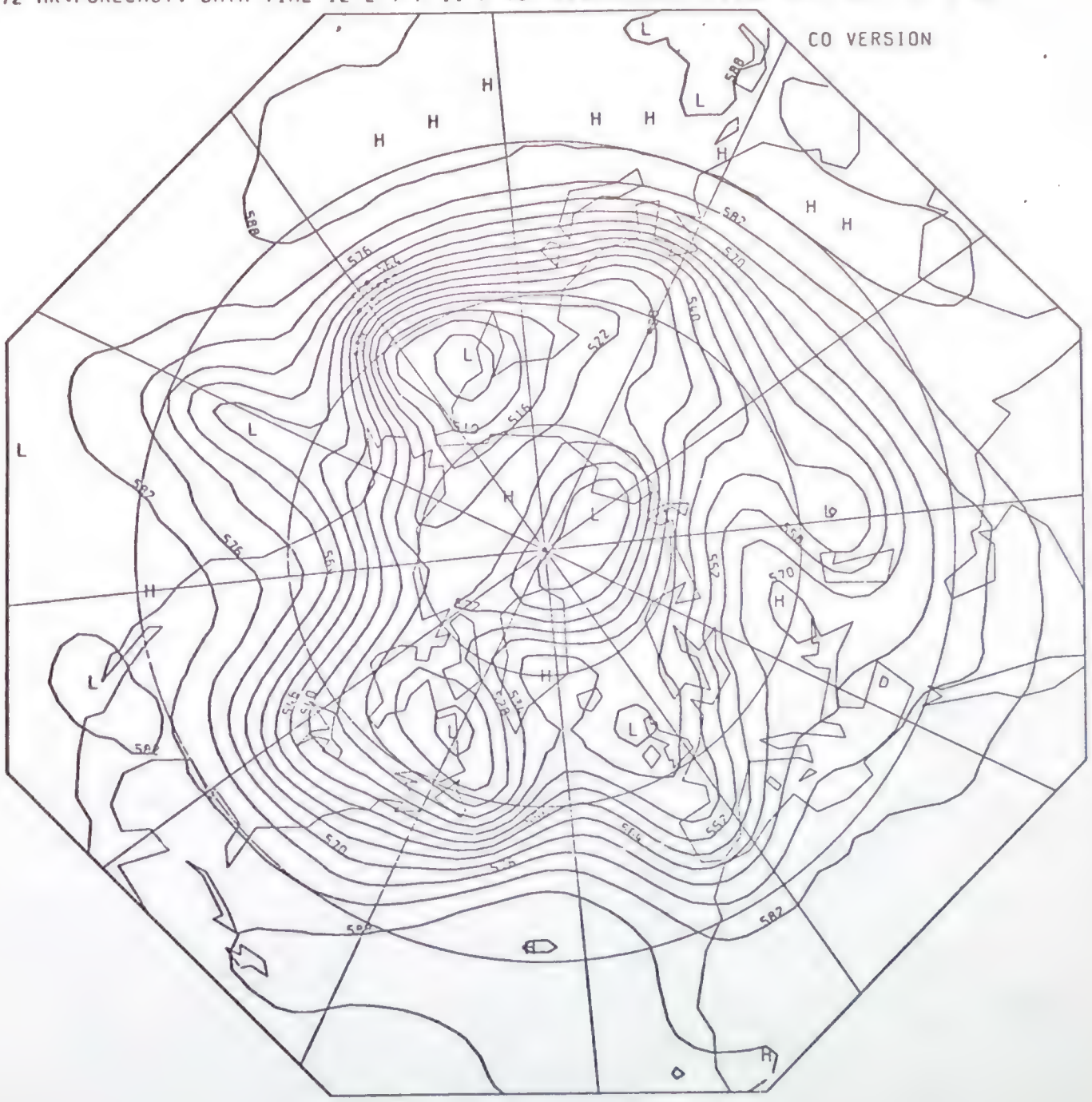
SI VERSION



1(e) TU(SE) 500MB HEIGHTS 10/11/76

500 MB CONTOURS CONTOUR LINES AT 6 DECAMETER INTERVALS

72 HR.FORECAST. DATA TIME 12 Z 7 / 11 / 76. VERIFICATION TIME 12 Z 10 / 11 / 76



1(f) TU 500MB HEIGHTS 10/11/76

SURFACE PRESSURE ISOBARS AT 4MB INTERVALS

0 HR.FORECAST. DATA TIME 12 Z 5 / 1 / 77. VERIFICATION TIME 12 Z 5 / 1 / 77

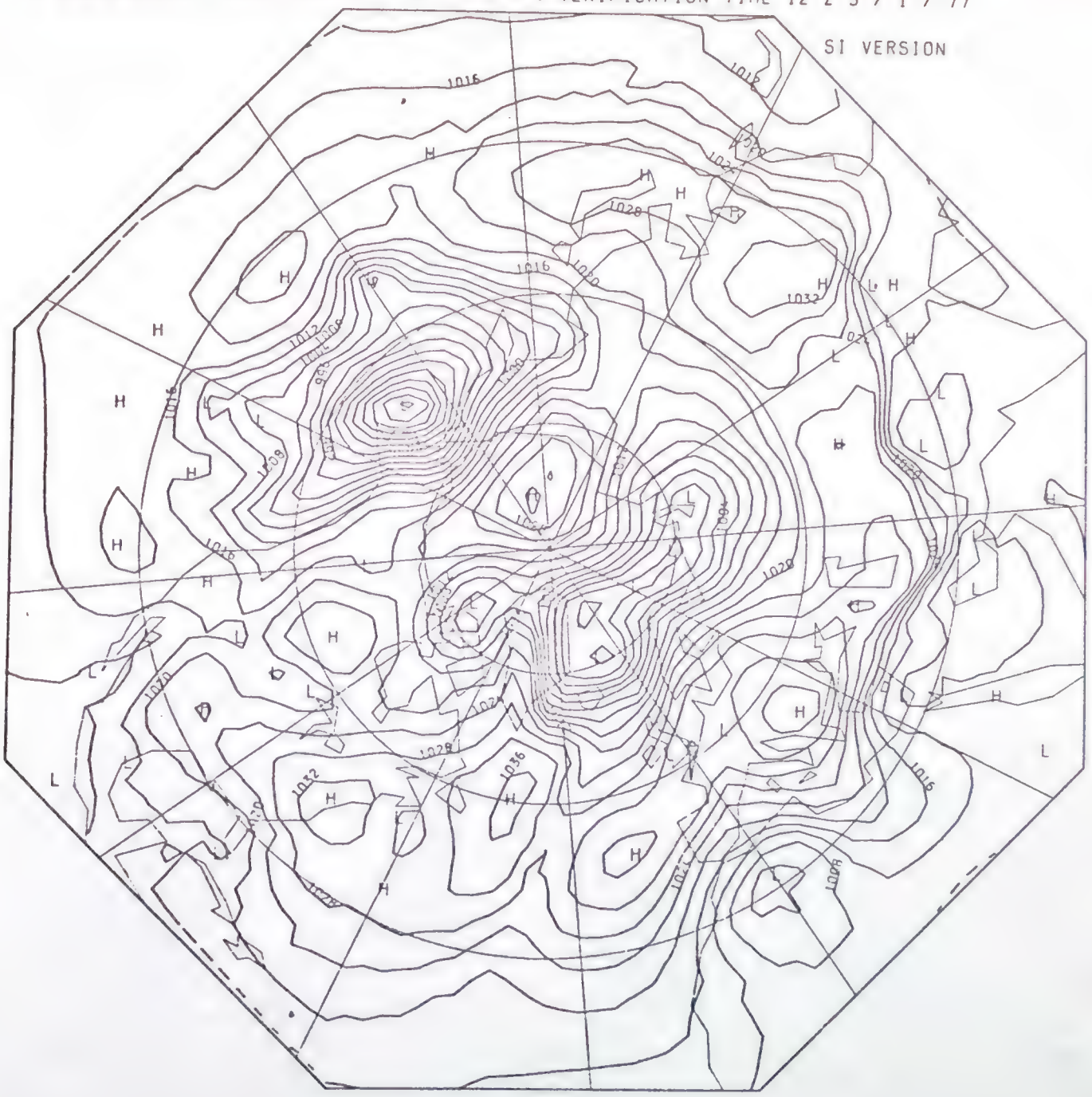
SI VERSION

2 (a) ACTUAL SURFACE PRESSURE 5/1/77

SURFACE PRESSURE ISOBARS AT 4MB INTERVALS

72 HR.FORECAST. DATA TIME 12 Z 2 / 1 / 77. VERIFICATION TIME 12 Z 5 / 1 / 77

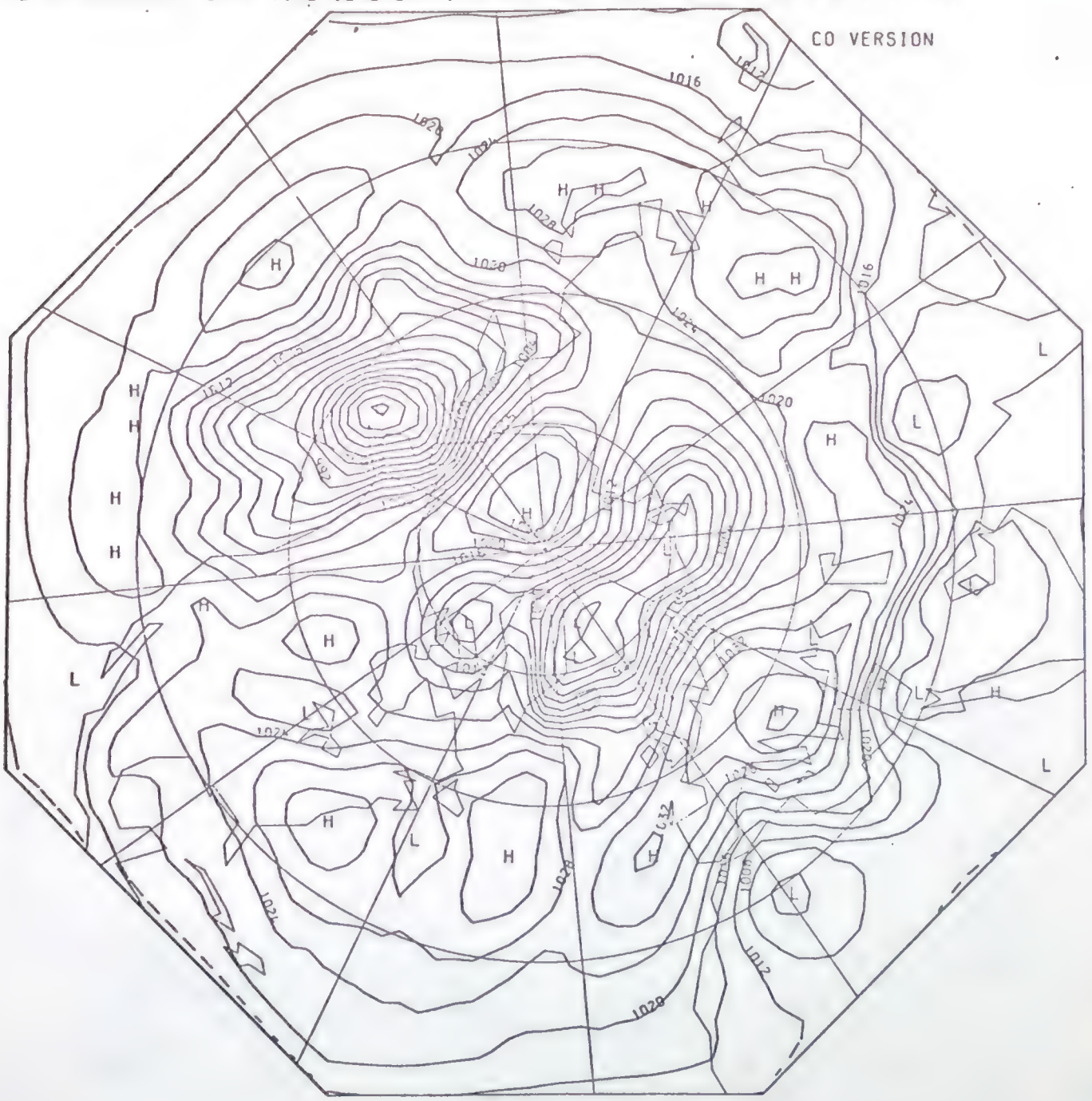
SI VERSION



2(b) TU(SE) SURFACE PRESSURE 5/1/77

SURFACE PRESSURE ISOBARS AT 4MB INTERVALS

72 HR.FORECAST. DATA TIME 12 Z 2 / 1 / 77. VERIFICATION TIME 12 Z 5 / 1 / 77



2 (c) TU SURFACE PRESSURE 5/1/77

500 MB CONTOURS CONTOUR LINES AT 6 DECAMETER INTERVALS

0 HR.FORECAST. DATA TIME 12 Z 5 / 1 / 77. VERIFICATION TIME 12 Z 5 / 1 / 77

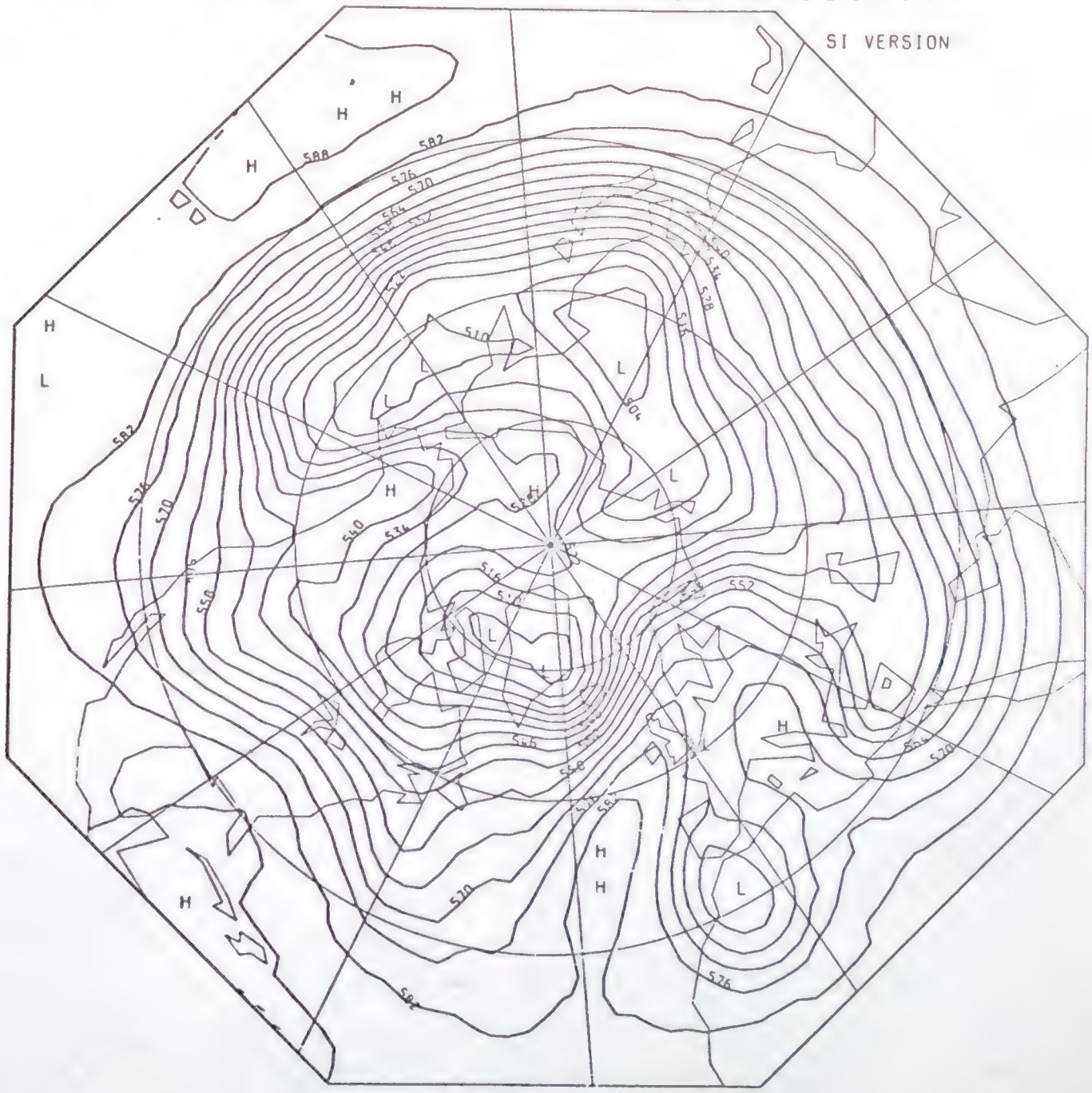
SI VERSION

2 (a) ACTUAL 500MB HEIGHTS 5/1/77

500 MB CONTOURS CONTOUR LINES AT 6 DECAMETER INTERVALS

72 HR.FORECAST. DATA TIME 12 Z 2 / 1 / 77. VERIFICATION TIME 12 Z 5 / 1 / 77

SI VERSION

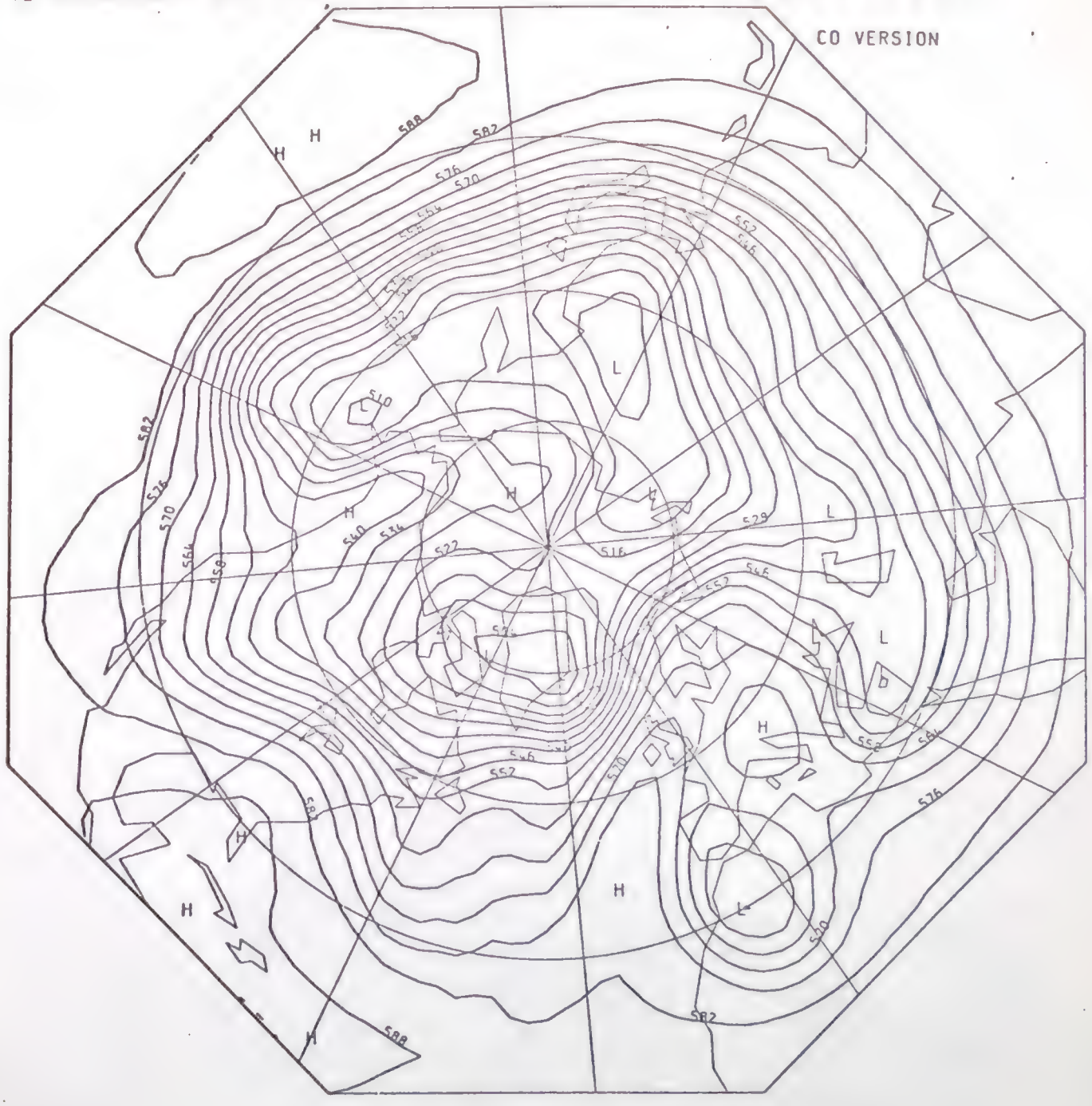


2(c) TU(SE) 500MB HEIGHTS 5/1/77

500 MB CONTOURS CONTOUR LINES AT 6 DECAMETER INTERVALS

72 HR.FORECAST. DATA TIME 12 Z 2 / 1 / 77. VERIFICATION TIME 12 Z 5 / 1 / 77

CO VERSION


H
H
588
582
576
570
564
558
552
546
L
510
582
576
570
564
558
H
540
534
522
516
H
529
L
546
552
L
H
H
H

SURFACE PRESSURE ISOBARS AT 4MB INTERVALS

0 HR.FORECAST. DATA TIME 12 Z 26 / 1 / 77. VERIFICATION TIME 12 Z 26 / 1 / 77

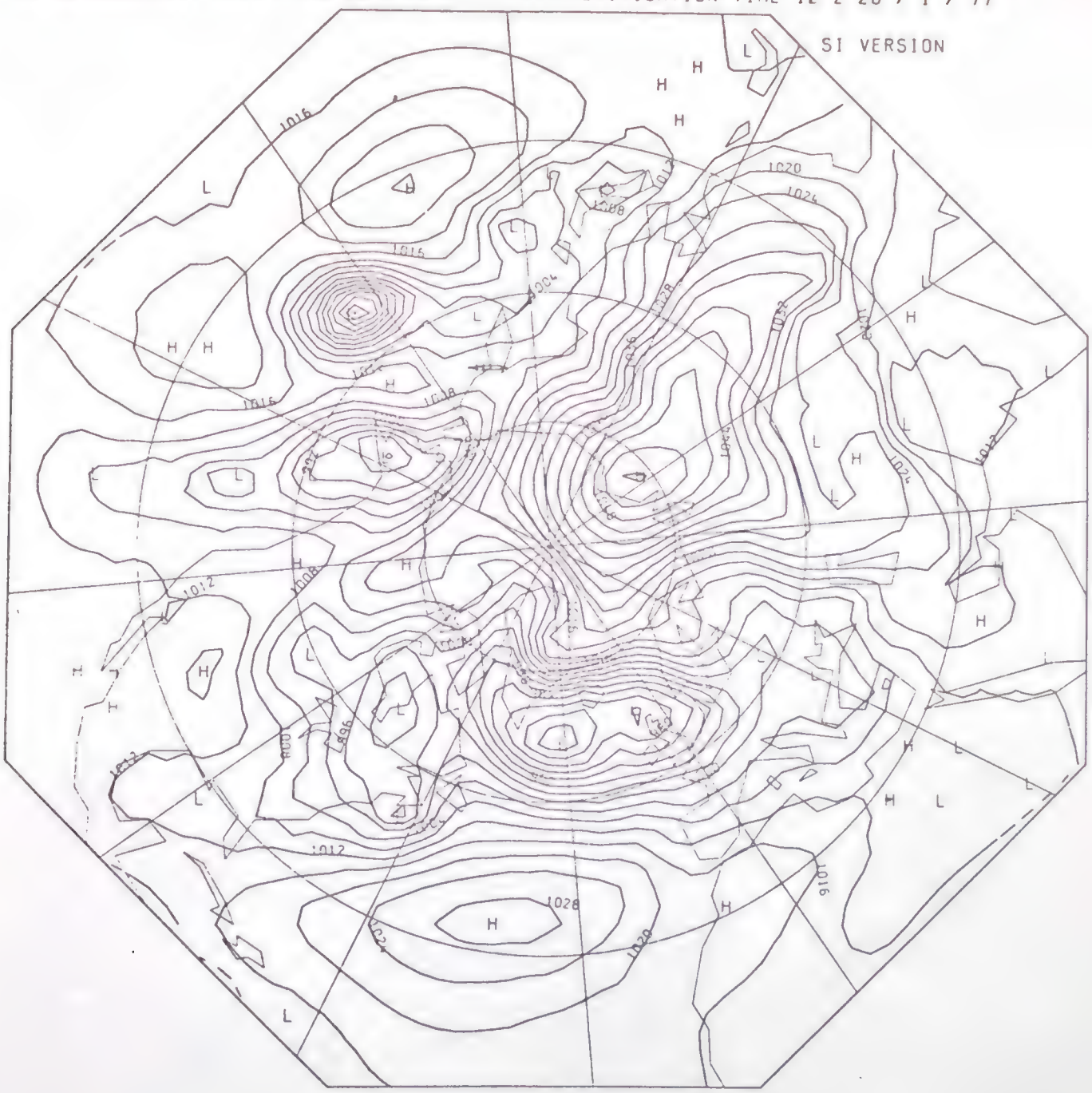
SI VERSION

3 (a) ACTUAL SURFACE PRESSURE 26/1/77

SURFACE PRESSURE ISOBARS AT 4MB INTERVALS

72 HR.FORECAST. DATA TIME 12 Z 23 / 1 / 77. VERIFICATION TIME 12 Z 26 / 1 / 77

SI VERSION

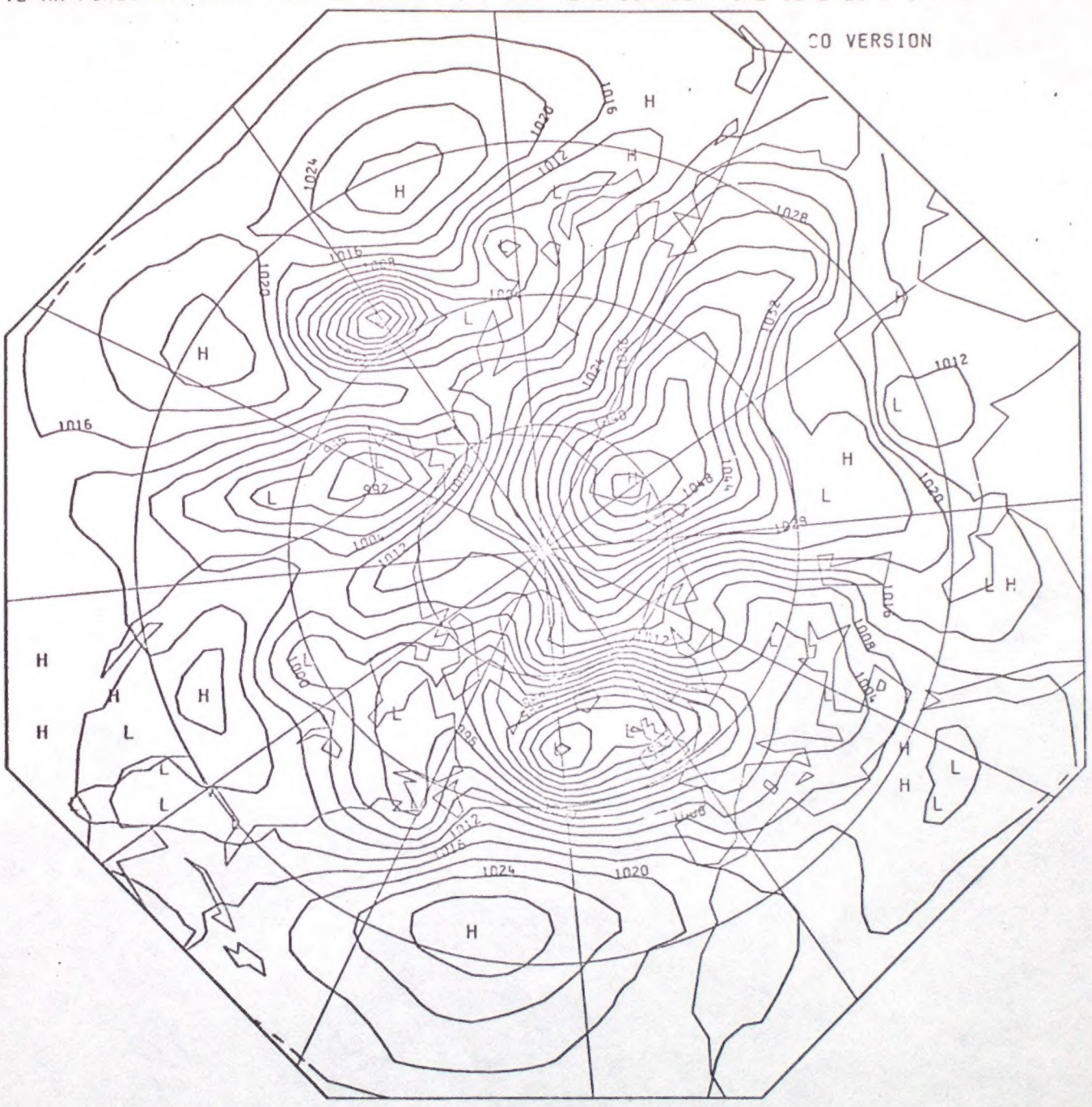


3(b) TU(SE) SURFACE PRESSURE 26/1/77

SURFACE PRESSURE ISOBARS AT 4MB INTERVALS

72 HR.FORECAST. DATA TIME 12 Z 23 / 1 / 77. VERIFICATION TIME 12 Z 26 / 1 / 77

CO VERSION

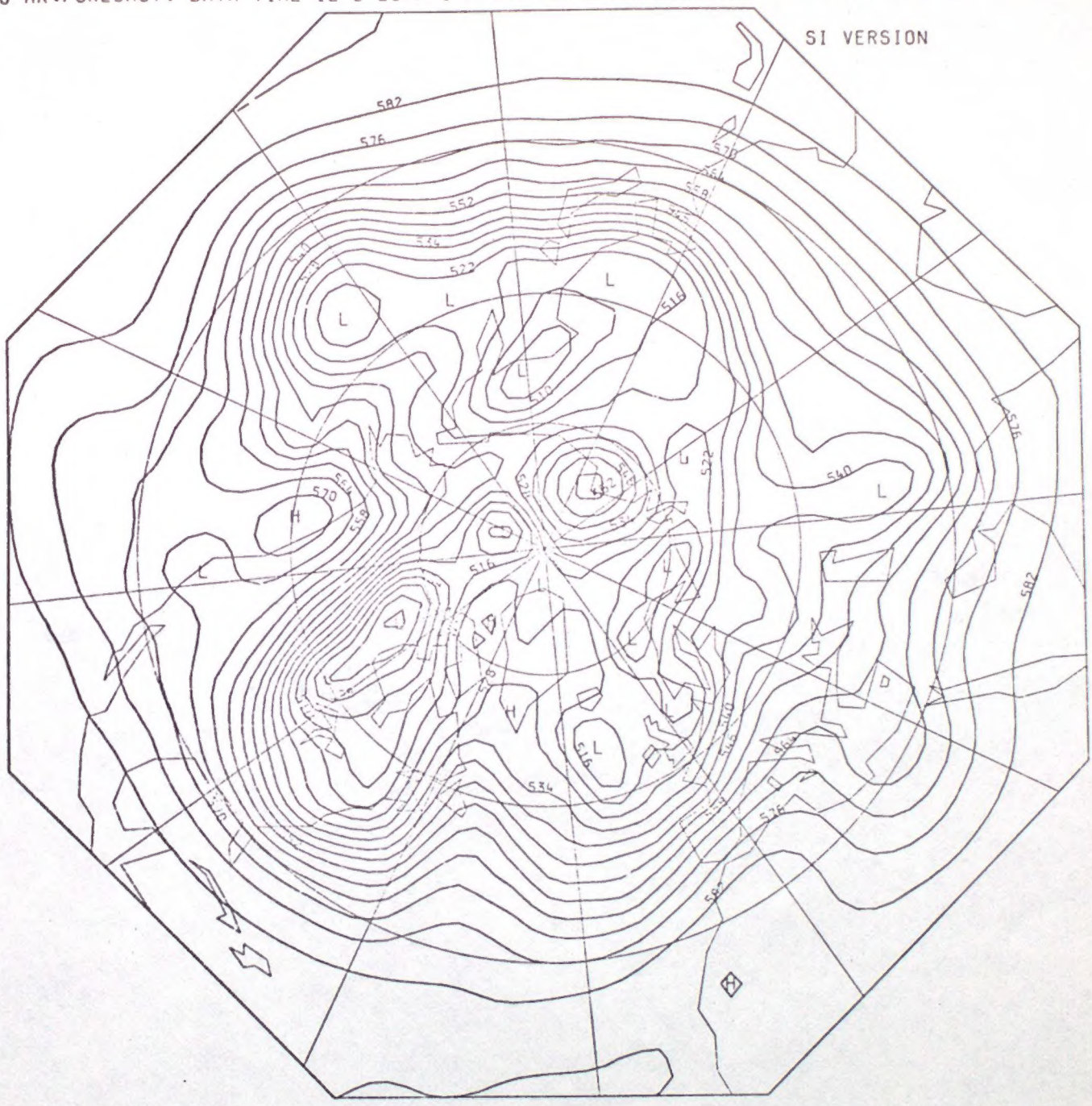


3 (c) TU SURFACE PRESSURE 26/1/77

500 MB CONTOURS CONTOUR LINES AT 6 DECAMETER INTERVALS

0 HR.FORECAST. DATA TIME 12 Z 26 / 1 / 77. VERIFICATION TIME 12 Z 26 / 1 / 77

SI VERSION

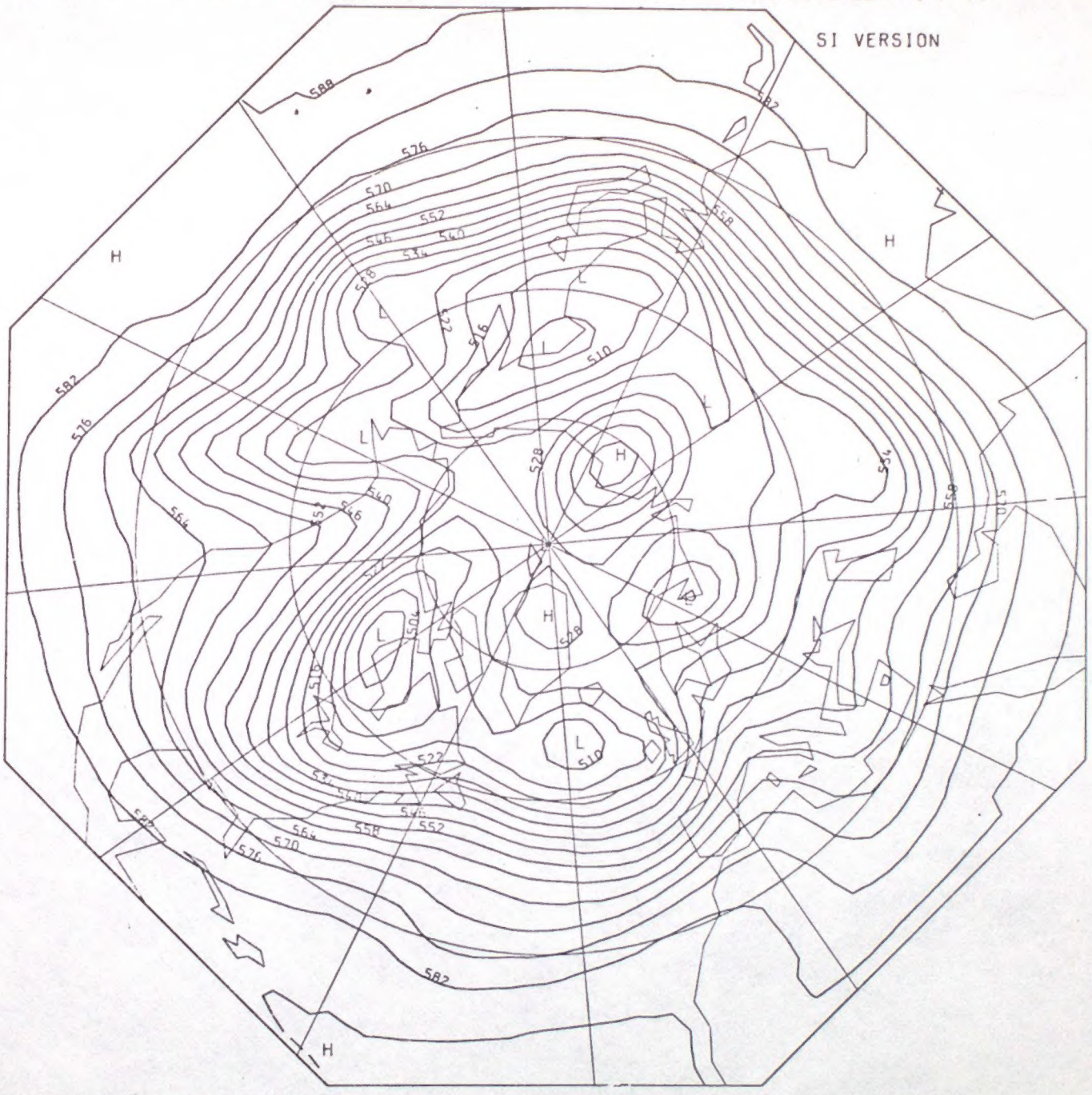


3 (d) ACTUAL 500MB HEIGHTS 26/1/77

500 MB CONTOURS CONTOUR LINES AT 6 DECAMETER INTERVALS

72 HR.FORECAST. DATA TIME 12 Z 23 / 1 / 77. VERIFICATION TIME 12 Z 26 / 1 / 77

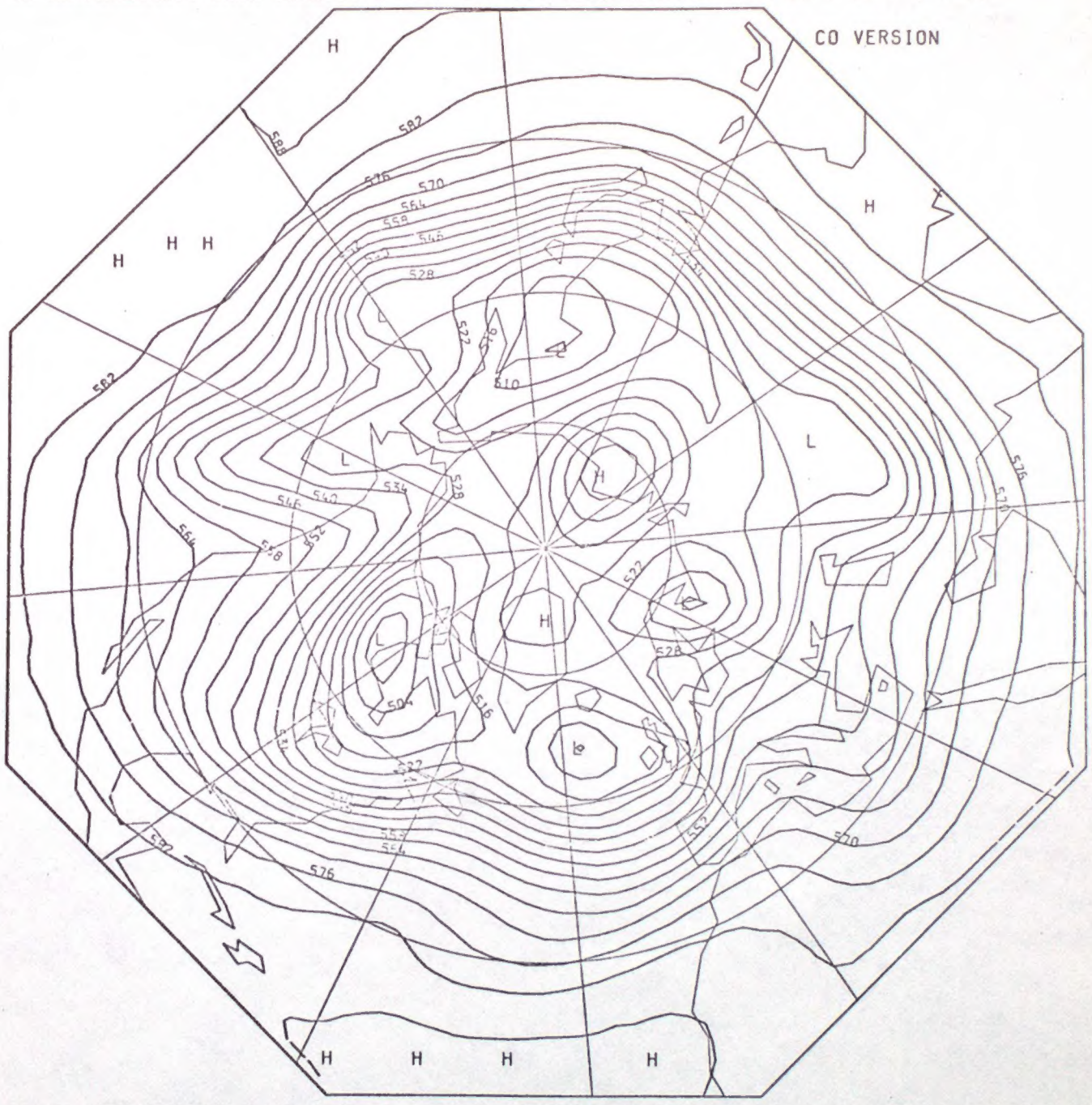
SI VERSION



3(e) TU(SE) 500MB HEIGHTS 26/1/77

500 MB CONTOURS CONTOUR LINES AT 6 DECAMETER INTERVALS

72 HR.FORECAST. DATA TIME 12 Z 23 / 1 / 77. VERIFICATION TIME 12 Z 26 / 1 / 77



3 (f) TU 500MB HEIGHTS 26/1/77